

## WHAT IS CLAIMED IS:

- 1                   1.     A waveguide device which acts as a waveguide in at least one  
2     direction thereof, the device comprising:  
3                   a core having a pump input surface for receiving pumping radiation  
4     at a pumping wavelength and at least one output surface for emitting a laser beam  
5     at an output wavelength; and  
6                   means for providing pump-light confinement and means for providing  
7     output mode control in different sections of the device along the direction of beam  
8     propagation.
- 1                   2.     The device as claimed in claim 1 wherein the core is a single  
2     member.
- 1                   3.     The device as claimed in claim 1 wherein the core includes  
2     an active core member and a passive core member.
- 1                   4.     The device as claimed in claim 1 wherein the means for  
2     providing pump-light confinement includes a pump-light containment component in  
3     contact with a surface of the core in a pumping section of the device.
- 1                   5.     The device as claimed in claim 4 wherein the pump-light  
2     containment component is a pump cladding.
- 1                   6.     The device as claimed in claim 1 wherein the means for  
2     providing output mode control includes a coating in contact with the core.
- 1                   7.     The device as claimed in claim 5 wherein the means for  
2     providing output mode control includes a mode control cladding in contact with the  
3     core.
- 1                   8.     The device as claimed in claim 1 wherein the means for  
2     providing output mode control includes a grating in contact with the core.

1 9. The device as claimed in claim 1 wherein the core is a planar  
2 core.

1 10. The device as claimed in claim 1 wherein the core is a  
2 cylindrical core.

1 11. The device as claimed in claim 1 further comprising a  
2 substrate for supporting the core.

1 12. The device as claimed in claim 1 wherein the device is a laser.

1 13. The device as claimed in claim 12 wherein the laser is a  
2 planar waveguide laser.

1 14. The device as claimed in claim 1 wherein the core has laser  
2 input surface for receiving a source laser beam to be amplified and wherein the  
3 device is a optical amplifier.

1 15. The device as claimed in claim 14 wherein the core is planar  
2 and wherein the optical amplifier is a planar waveguide amplifier.

1 16. The device as claimed in claim 14 wherein the laser input  
2 surface is different from either the pumping input surface or the at least one output  
3 surface.

1 17. The device as claimed in claim 14 wherein the laser input  
2 surface is the same as the at least one output surface.

1 18. The device as claimed in claim 1 wherein an output mode  
2 control section of the device has a lower NA than a pumping section of the device.

1                    19.    The device as claimed in claim 18 wherein the pumping  
2    section has a NA greater than 0.05.

1                    20.    The device as claimed in claim 18 wherein the output mode  
2    control section has a NA less than 0.22.

1                    21.    The device as claimed in claim 9 wherein the planar core  
2    includes doped YAG.

1                    22.    The device as claimed in claim 5 wherein the pump cladding  
2    has a lower refractive index than the refractive index of the core.

1                    23.    The device as claimed in claim 22 wherein the pump cladding  
2    is sapphire or undoped YAG.

1                    24.    The device as claimed in claim 7 wherein the mode control  
2    cladding includes a material having a refractive index between that of the core and  
3    that of the pump cladding.

1                    25.    The device as claimed in claim 24 wherein the mode control  
2    cladding includes doped or undoped YAG.

1                    26.    The device as claimed in claim 9 wherein the planar core  
2    includes a first core member which absorbs the pumping radiation and a separate  
3    second core member which either does not absorb the pumping radiation or has an  
4    absorption lower than the absorption of the first core member at the pumping  
5    wavelength.

1                    27.    The device as claimed in claim 9 wherein the device acts as  
2    a pair of separate waveguides which are butt-coupled or coupled together by an  
3    imaging system.

1                   28.    The device as claimed in claim 18 wherein the device is an  
2   optical fiber.

1                   29.    The device as claimed in claim 28 wherein the means for  
2   providing output mode control includes a mode control cladding different from the  
3   pump cladding.

1                   30.    The device as claimed in claim 29 wherein the device  
2   comprises sections of different types of fiber which are either spliced, butt-coupled  
3   or coupled together by imaging an output from one section into the other section.

1                   31.    A method for generating a laser beam having a desired output  
2   mode, the method comprising:

3                   providing a core having a pump input surface and at least one output  
4   surface, the core serving as a waveguide in at least one direction;

5                   pumping the core at the pump input surface with pumping radiation  
6   at a pumping wavelength so that an output laser beam is emitted at the at least one  
7   output surface at an output wavelength; and

8                   separating the functions of pump-light confinement and output mode  
9   control to different sections along the length of the waveguide.

1                   32.    The method as claimed in claim 31 wherein the core has a  
2   laser input surface and wherein the method further comprises transmitting a source  
3   laser beam into the core at the laser input surface wherein the source laser beam is  
4   amplified within the core and wherein the output beam is an amplified source laser  
5   beam.